

Rejections Under 35 USC § 103

The Examiner alleges that it would have been obvious at the time the invention was made to treat any sulfur-containing feed with the additive-containing catalyst of Yamaguchi et al. (US 5,468,709), because Yamaguchi does not limit the specific types of sulfur-containing oils. It is respectfully submitted that this argument ignores the context in which the Yamaguchi invention was made. A skilled person would read Yamaguchi in the context of its background, and recognize the implied properties of the feed and product described therein.

As explained in the Plantenga Declaration, at the time Yamaguchi originated, in 1992, HDS was effected to reduce the sulfur content of a feedstock from a value of the order of a few percent to a value of about 0.15 wt.% (1500 ppm). Accordingly, the skilled person will recognize that Yamaguchi relates to catalysts suitable for effecting conventional HDS, because this was the only HDS process known at the time of origin of Yamaguchi. Note in this context that Yamaguchi does not disclose anything about the sulfur content of the product; only relative activities are given.

As is further explained in the Plantenga Declaration, the conventional HDS described in Yamaguchi and the ultra-deep HDS that is the subject of the present invention are comparable only in name. They differ in feedstock properties, in product properties, in compounds to be converted and in reaction mechanisms. Conventional HDS involves conversion of sulfides, disulfides, thiophenes and benzothiophenes via direct sulfur extraction, as opposed to ultra-deep HDS that deals mainly with the conversion of alkylated dibenzothiophenes via hydrogenation followed by sulfur extraction .

Another very important consideration, as further described in the Declaration of Dr. Plantenga, was the surprising discovery which revealed that

the activity ranking for ultra-deep HDS differed from the activity ranking known for conventional HDS and the catalysts with the best performance in conventional HDS did not show the best performance in ultra-deep HDS. The catalyst of Yamaguchi is evidently eminently suitable for conventional HDS. See, for example, in Table 3 the relative activity of 242 of catalyst AAA (a dried additive-containing catalyst according to Yamaguchi) as compared to a relative activity of 100 for catalyst AAI (a conventional calcined hydrotreating catalyst).

Thus, in view of the very high activity of the Yamaguchi catalyst in conventional HDS, the skilled person would conclude that the chances of this catalyst performing well in ultra-deep HDS would be very low indeed.

Therefore, at the time the present invention was made, one of ordinary skill in the art would not only have no reason to believe that catalysts effective for conventional HDS as in Yamaguchi would be effective for ultra-deep HDS, because of the completely different sulfur chemistry involved in the respective processes, that person would be actually dissuaded from using the catalyst of Yamaguchi in ultra-deep HDS in view of the knowledge that a good HDS catalyst will generally not be a good catalyst for ultra-deep HDS.

Furthermore, the only metals illustrated in the catalyst of Yamaguchi for desulfurization are Co-Mo. The present invention requires Ni-Mo. To apply Yamaguchi to ultra-deep HDS one skilled in the art would have to know to arbitrarily substitute Ni for Co, an impermissible exercise in hindsight that could be achieved only through knowledge of the present invention.

It is true, as the Examiner states, that Co is not excluded by applicants' claims. Yamaguchi, however, only shows the use of Co for HDS. The instant claims require Ni.

The Examiner also rejects the present claims as being obvious over EP 870 817 in view of Yamaguchi. As indicated above, Yamaguchi describes catalysts for conventional HDS. As has been explained above, a skilled person seeking a catalyst suitable for use in ultra-deep HDS would not consider the conventional-HDS catalysts described in Yamaguchi, because he would have no reason to believe that these catalysts would work in ultra-deep HDS.

Absent from EP 870 817 is any hint to employ an organic additive as required by the instant claims. Yamaguchi discloses use of an organic additive to contribute to catalyst activity, but catalyst activity is related to the chemistry of the sulfur compounds to be converted. For some reason the additive of Yamaguchi results in a catalyst that is highly active in the above described sulfur-compound conversion process that takes place in conventional HDS, as opposed to the above described sulfur-compound conversion process that takes place in ultra-deep HDS.

Yamaguchi is unclear about the reaction mechanism involving the organic additive. He explicitly states that he does not understand what is going on. He indicates that it may have something to do with the prevention of agglomeration, but the causal effect between additive, metals agglomeration, and activity is unclear.

There is nothing in Yamaguchi which would lead a skilled person to the expectation or even the suggestion that something which, for unclear reasons, increases the activity of a catalyst in the conversion of sulfides, disulfides, thiophenes and benzothiophenes via direct sulfur extraction would also be good in the conversion of alkylated dibenzothiophenes via hydrogenation followed by sulfur extraction. There would thus be no expectation of success in combining EP 870 817 with Yamaguchi.

Conclusion

The present invention is not obvious over Yamaguchi, because to arrive at the present invention from the disclosure of Yamaguchi one of ordinarily skill in the art would have to somehow know that a certain catalyst effective in conventional HDS would also be effective in ultra-deep HDS, in spite of the chemistry of the two processes being completely different and knowledge that a good HDS catalyst will generally not be a good catalyst for ultra-deep HDS.

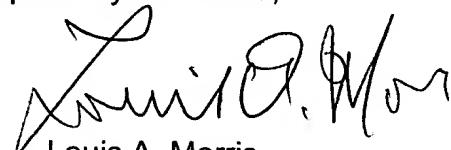
He would also have to know to disregard the teaching in Yamaguchi of the use of Co, and use Ni instead of or in addition to Co.

To combine Yamaguchi and EP 0 870 817 to arrive at the present invention, one of ordinary skill in the art would also somehow have to know to use the organic additive of Yamaguchi in the process of EP 870 817, again, in spite of the chemistry of the two processes being completely different.

Any of the above would in fact be exercises in hindsight, clearly not permitted under the law. The claimed subject matter is thus non-obvious over Yamaguchi, or the combination of Yamaguchi and EP 0 870 817.

It is respectfully requested that instant claims 1-8 be allowed and that the present application proceed to issue in due course.

Respectfully submitted,



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